

Claims

1. A bioabsorbable plug implant, suitable for bone tissue regeneration, comprising a first portion, and a second portion extending outwardly from the first portion, the first and second portions formed from expandable material.  
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2. The plug implant of the claim 1, wherein the plug implant is shaped like a cone, truncated-cone, a pentahedron, a truncated-pentahedron, and/or a button mushroom.
3. The plug implant of claims 1-2, wherein the first portion comprises a first surface, and the second portion comprises a second surface, opposite to the first, the first surface having an area smaller than the area of the second surface.  
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4. The plug implant of claims 1-3, wherein the first and second surface are plane surfaces.
5. The plug implant of claims 1-4, wherein the first and the second surfaces have circular, square or rectangular shapes.  
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6. The plug implant of claims 1-4, wherein the plug implant has a tapered shape.
7. The plug implant of claims 1-6, wherein the first portion has a thickness X, and the second portion has a thickness Y, the ratio X:Y being from 1:1 to 10:1  
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8. The plug implant of claims 1-7, wherein the expandable material is a porous material.
9. The plug implant of claims 1-8, wherein the expandable material comprises bioresorbable polycaprolactone (PLC).  
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10. The plug implant of claims 1-9, wherein the expandable material is prepared by layering PLC filaments layer by layer.
11. The plug implant of claims 1-10, wherein the material is prepared by layering PLC filaments layer by layer by using the Fused Deposition Modeling (FDM) technology.  
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12. The plug implant of claims 9-11, wherein the PLC filament layers have an orientation of 0 degree, 60 degree and/or 120 degree.
13. The plug implant of claims 1-12, wherein the wherein the expandable material comprises bioresorbable tricalcium phosphate-polycaprolactone (TCP-PLC).  
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14. The plug implant of claim 13, wherein the TCP-PLC is TCP-PLC 20:80%.
15. The plug implant of claims 13-14, wherein the TCP-PLC has 60-70% of porosity.
16. The plug implant of claims 1-15, wherein the plug implant comprises an opening for placement and removal of a catheter.  
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17. The plug implant of claims 1-16, wherein the plug implant expands at contact with hydrophilic solution, hydrophilic liquid and/or body fluid.
18. The plug implant of claims 1-17, wherein the plug implant is suitable to be inserted into a defect of a bone and the plug implant does not require means for fixing the plug to the external surface of the bone.  
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19. The plug implant of claims 1-18, further comprising a bioactive agent.
20. The plug implant of claims 1-19, further comprising cells seeded on the bioabsorbable scaffold of the plug implant.
21. The plug implant of claim 20, wherein the cells are stem cells.

22. The plug implant of claims 20-21, wherein the cells are mesenchymal stem cells.

23. A method for bone tissue regeneration comprising the steps of:

5 providing a bioabsorbable plug implant, wherein the implant comprises a first portion and a second portion extending outwardly from the first portion, the first and second portions formed from expandable material;

inserting the second portion into a defect or gap of a bone, the first surface engaging the outside contour of the defect or gap;

10 allowing the plug implant to contact body fluids, thereby expanding the size of the plug implant so that the plug fits into the defect or gap.

24. The method of claim 23, wherein the implant comprises a first and a second surface, opposite to each other, the first surface having an area smaller than the area of the second surface.

15 25. The method of claims 23-24, wherein the plug implant is shaped like a cone, truncated-cone, a pentahedron, a truncated-pentahedron, and/or a button mushroom.

26. The method of claims 23-25, wherein the first and second surface are plane surfaces.

20 27. The method of claims 23-26, wherein the first and the second surfaces have circular, square or rectangular shapes

28. The method of claims 23-27, wherein the plug implant is formed from a porous material allowing the bone cells to penetrate into the plug implant and to regenerate the bone tissue.

29. The method of claims 23-28, which is a method for performing cranioplasty.
30. The method of claims 23-29, wherein plug implant and the bone defect or gap have an initial tolerance of less than 1 mm.
- 5 31. The method of claim 30, wherein the initial tolerance is less than 0.5 mm.
32. The method of claim 30, wherein the initial tolerance is less than 0.2 mm.
33. The method of claims 23-32, wherein the first portion has a thickness X, and the second portion has a thickness Y, the ratio X:Y being from 1:1 to 10:1.
- 10 34. The method of claims 23-33, wherein the expandable material comprises bioresorbable polycaprolactone (PLC).
35. The method of claims 23-34, wherein the expandable material is prepared by layering PLC filaments layer by layer.
36. The method of claims 34-35, wherein the material is prepared by layering  
15 PLC filaments layer by layer by using the Fused Deposition Modeling (FDM) technology.
37. The method of claims 34-36, wherein the PLC filament layers have an orientation of 0 degree, 60 degree and/or 120 degree.
38. The method of claims 34-37, wherein the expandable material comprises  
20 bioresorbable tricalcium phosphate-polycaprolactone (TCP-PLC).
39. The method of claim 38, wherein the TCP-PLC is TCP-PLC 20:80%.
40. The method of claims 38-39, wherein the TCP-PLC has 60-70% of porosity.

41. The method of claims 23-40, further comprising placing catheter into an opening of the plug implant for performing drainage.
42. The method of claims 23-41, wherein the insertion of the plug implant into the bone defect does not require means for fixing the plug to the external surface of the bone surrounding the defect.
43. The method of claims 23-42, wherein the method is a non therapeutic method for the cosmetic restoration of undesirable osseous gaps.
44. The method of claims 23-43, wherein the plug implant further comprising a bioactive agent.
45. The method of claims 23-44, wherein the plug implant further comprising cells seeded on the bioabsorbable scaffold of the plug implant.
46. The method of claim 45, wherein the cells are stem cells.
47. The method of claims 45-46, wherein the cells are mesenchymal stem cells.
48. A kit comprising the plug implant of claims 1-22.